

The Effect of Subtenons Lidocaine on Emergence Agitation after General Anesthesia in Pediatric Strabismus Surgery

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doi: 10.19044/esj.2016.v12n6p48 [URL:http://dx.doi.org/10.19044/esj.2016.v12n6p48](http://dx.doi.org/10.19044/esj.2016.v12n6p48)

Abstract

Objectives: To study the effect of subtenon lidocaine injection at the end of intervention on the post-operative emergence agitation in pediatric strabismus surgery under general anesthesia with sevofluran.

Material: We studied 191 children patients undergoing muscle surgery for strabismus from 2-6 years old. Children were (prospectively) randomized to one of the four groups. These groups include: A –Group Sevofluran fentanyl; B –Group sevoflurane fentanyl, Subtenon lidocaine injection; C – Group Propofol, fentanyl, sevofluran; and D – Group Propofol, fentanyl, Sevoflurane, Subtenon lidocaine injection. In the beginning of the induction of anesthesia, children received dexametasone and metoclopropamide. At the end of the surgery, children received either lidocaine (2%) or normal saline (1ml) into the subtenons space. This was conducted on the recovery room using five scoring scale. These scale include: 1- the child makes eye contact, 2- Purposeful response after repeated stimuli, 3 – the child is aware of the surrounding environment, 4- severe restlessness, and 5 – The child is inconsolable. The degree of emergence agitation was observed. Furthermore, the score 4 and 5 was considered as an emergence agitation.

Results: There are no differences regarding age and weight. The incidence of emergence agitation was significantly lower in the groups which were receiving subtenon lidocaine compared with saline group injections ($p < 0.05$).

Conclusions: A lidocaine injection into subtenon space reduces the emergence agitation after general anesthesia in pediatric strabismus surgery.

Keywords: Emergent agitation, sevoflurane, strabismus, children, subtenon

Introduction

The emergence agitation (EA), postoperative excitement or emergence delirium, is observed and well documented after anesthesia with sevoflurane (Constant I et al., 2010; Veckermans f, 2001; MartiniDr, 2005; Krelani N, 2007; Vepell Lewis, 2003). The agitation occurs within 30 min from recovery by the anesthesia and lasts typically between 5 – 15 min (Constant I et al., 2010; Meyer Pahoulis et al., 1993; Delvin JV et al., 2006; Theuercauf Gp et al., 2012; Guentear V et al., 2011). Emergency agitation (EA) is a clinical status when the patient is awake but is disorientated. It is described as mental disturbances that consist of confusion, hallucinations, and delusions which is manifested by restless involuntary physical activity and thrashing about the bed (Oh AY et al., 2005; Menca SB et al., 2007; Mizuro J et al., 2011; Martini RD, 2005; Voepel I lewis et al., 2003;Vajocarvici GP, 2012). Therefore, the reasons behind the higher incidence of emergent agitation following sevoflurane anesthesia still remains unknown (Voepel I Lewis, 2003; Haynes,1999; Cavaliere F et al., 2005). This phenomenon is thought to be due to low blood-gas solubility and rapid recovery characteristic of sevofluran. Sevoflurane causes epileptogenetic activity that contributes to EA behaviors (Sikich et al., 2004). The overall rate for EA in children ranges from 10% to 67%. This includes a period of severe restlessness, disorientation, and inconsolable crying during anesthesia emergence (Martini RD, 2005; Cavaliere F et al., 2005; Liberati A, 2009; Theuercauf et al., 2012). Early childhood (2- 5 years) has been considered as a risk factor because of expected confusion and fright in this age group (Konz N et al., 1999; Moher D, 2009; Delvin JW et al., 2006). Thus, the higher incidence in early childhood supposed to occur presumably due to the lack of experience. Also, it occurs as a result of developmental analyses that restrict understanding and heighten fears. The other risk factors include prolonged operative procedures, pain, preoperative anxiety, neurological condition, and mental diseases. The aggressive treatment of surgical pain is essential to avoid screaming emergence (Menca SB et al., 2007; MartiniDR, 2005; Mizuro J et al., 2011; Cole JW, 2002). The incidence ranges from 10 to 80 % (Oh AY et al., 2005; Picard V et al., 2008; Karlani N, 2007; Vepel I Lewis et al., 2003). It is higher in children who are between 2 – 6 years old. The increased incidence of EA has been observed especially in pediatric ophthalmology care units. The factors that could increase the incidence of emergency agitation in ophthalmology are pain, mental status, time of operation, age, the relation with distortion, lack of ability to see outside, and a history of previous hyperthermia as an etiologic risk factor of strabismus in some cases (Cole JW, 2002;Vepel I Lewis et al., 2003; Cavaliere F, 2005). Pain treatment during the intra and post-operative periods represents a fundamental condition in EA control. The aim of our

study is to primarily evaluate the benefits of subtenon lidocaine versus saline injection. However, this is combined with intravenous and general anesthesia in preventing the EA, on the requirements of postoperative analgesics in small children undergoing strabismus surgery.

Methods

After the institutional ethics committee approval and informed written parental consent, 191 ASA I and II children aged between 2 – 6 years old underwent strabismus surgery from January 2011 to December 2014 in the eye clinic “Mother Theresa” University Hospital Center. Therefore, children were randomized into four groups according to the anesthesia strategy.

Group 1 (S.F.S) n =46. Induction was done on sevoflurane with facial mask. Sevoflurane and fentanyl were used for maintenance of anesthesia and saline subtenon at the end of operation.

Group 2 (S.F.Subtenon) n = 51. Sevoflurane with facial mask as induction, and maintenance of anesthesia was done with fentanyl, sevoflurane, and lidocaine (2%) subtenon at the end of operation.

Group 3 (S. F. P.) n = 43. Sevoflurane with facial mask, propofol as an induction of anesthesia, and maintenance of anesthesia was done with propofol fentanyl, sevoflurane, and saline at the end of operation.

Group 4 (S.F.P. Subtenon) n = 49. Sevoflurane with facial mask, propofol as an induction of anesthesia, and maintenance of anesthesia was done with fentanyl, propofol, sevoflurane, and subtenon at the end of operation .

Rectal midazolam (0.3 mg/kg) was given 20min before operation. All patients received dexamethasone 0.15 – 0.5 mg/kg at the beginning of induction for the antiemetic and analgesic effect. The airway was controlled by a laryngeal mask airway (LMA). Thus, no myorelaxants were used. Metoclopramide 0.1 – 0.15mg/kg was given for its antiemetic effects. Paracetamol (30 mg/kg) was intravenously injected 15 minutes before the end of the procedure as analgesic for controlling intra and postoperative pain. Intraoperative monitoring consisted of continuous electrocardiography, pulse oxymetry, non invasive blood pressure, and end-tidal CO₂ measurements. Heart rate and blood pressure were recorded before induction (baseline value) and at every 5 minutes during anesthesia and surgery until the end of the procedure. The maintenance of anesthesia was achieved with sevoflurane 1.5%, while fentanyl 2 –3 mcg/kg was employed for induction and maintenance. Propofol dose was 2.5-3.5 mg/kg. No other complications were recorded during and after the operation. Patient's behavior was assessed on recovery room for one hour. However, the agitation was

classified into five stages: 1 – The child makes eye contact with aggressivity; 2- The child actions are purposeful; 3–The child is aware of his/her surrounding environment; 4 – The child is restless; and 5 – The child is inconsolable (Krelani N, 2007; Sikich N et al., 2004). In addition, it is considered an Emergency Agitation only in those cases ranging between the fourth and fifth stages of classification.

Statistics

Results were expressed as mean \pm SD median and range or frequencies. Comparisons of numerical variables between groups were done by employing *t* test for independent samples (Liberati A, 2009; Moher D et al., 2009). Also, we want to test if the agitation depends on the age of the patients, sex of the patients, or the type of anesthesia inducted. To achieve this, we first analyzed the correlations of each variable with agitation as a total and for each different group (defined by the types of anesthesia strategy). Then, since we believe that the characteristics do not only affect the agitation status independently but that they are interrelated to each other, we tested the relationship between the dependent variable (agitation) and the independent variables by the use of a linear regression analysis. Means square method regression was applied (Leman J, 2013; Actins D et al., 2004; Beg CP et al., 1994; Bart J et al., 2009). The significance of the variables was controlled by means of probability. Consequently, the variable is considered to be statistically significant if the *p* value is lower than < 0.05 and the sign of relation is the expected one. The results have been considered within a confidence interval of 95%. The goodness of fit of the mode I was tested by *R*². In addition, statistical tests were performed through the use of views (Actins D et al., 2004; Da Silva et al., 2008).

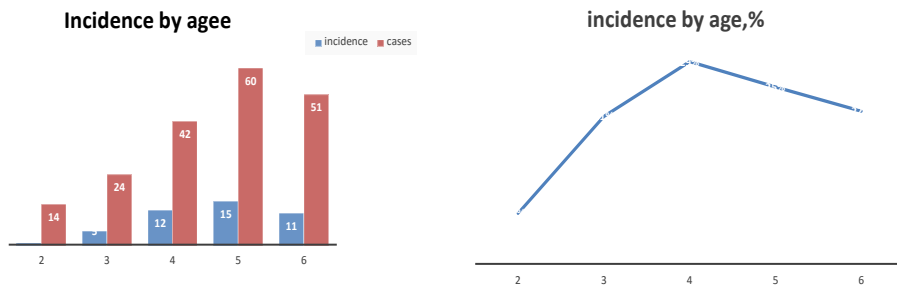
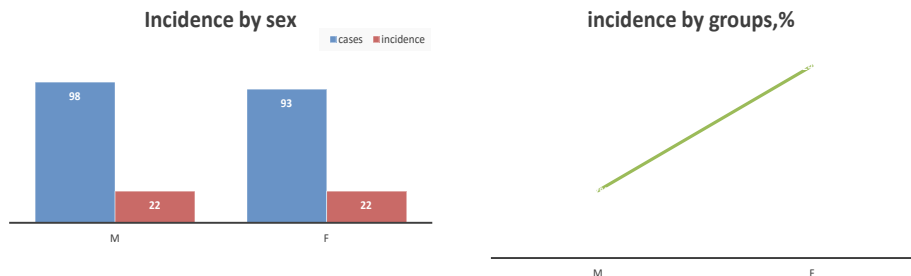
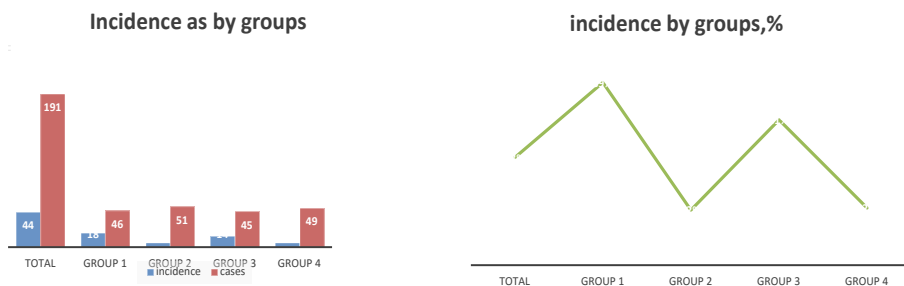
Results

Table 1 shows some descriptive statistics of the different groups of cases and the total number. No case were excluded from the patients.

Table 1. Descriptive statistics

Item	Group 1 (<i>n</i> =46)		Group 2 (<i>N</i> =51)		Group 3 (<i>n</i> =45)		Group 4 (<i>n</i> =49)		Total (<i>n</i> =191)	
	mean	st.dev	mean	st.dev	mean	st.dev	mean	st.dev	mean	st.dev
Age	4,39	1,37	4,35	1,20	4,62	1,17	4,94	1,05	4,58	1,22
Sex	0,59	0,50	0,47	0,50	0,40	0,50	0,49	0,51	0,49	0,50
Incidence	0,39	0,49	0,12	0,33	0,31	0,47	0,12	0,33	0,23	0,42

The graphs below show the incidence as by age and sex for the 4 different groups and the total number of cases.

Graph 1. Incidence by age**Graph 2. Incidence by sex****Graph 3. Incidence by strategies of an aesthesia**

In order to statistically evaluate the significance of age, sex, and the type of anesthesia on the incidence of agitation, we run individual linear. Hence, the significance was controlled by means of the probability of significance.

The table below show the results of the regressions. As we can observe, the type of anesthesia is the only significant variable that affects agitation.

Table 2

	Coefficients	Standard Error	t Stat	P-value
Sex	0,03	0,06	0,54	0,59
Age	0,02	0,03	0,66	0,51
Group	-0,06	0,03	-2,23	0,03

Since factors are interrelated and cannot be analyzed separately by the use of a linear regression, we tested the significance of the variables. Based on the results observed in the graph, we inserted a dummy variable for Groups of anesthesia 2 and 4.

Thus, the table below show the results of the linear relation.

Table 3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0,24	0,12	1,99	0,05
Sex	0,03	0,06	0,48	0,64
Age	0,02	0,02	0,89	0,38
Group	-0,23	0,06	-3,95	0,00

However, these results show that the submission of the group 2 and 4 of the incidence of agitation decreases.

Discussion

The incidence of the emergency agitation does not represent a rare phenomenon occurring during anesthesia with sevoflurane. The value varies from 20 – 80 %. Some others get 20-67%. We got the incidence of emergency agitation to be 44%. Consequently, there are many studies showing the factors which interfere with this complication and how to reduce it. Hence, these papers have studied the relation with pain, age, sex, type of operations, type of strategy, type of anesthesia, phyicological status before operation, and mental diseases. Early childhood represents a significant risk factor. On the ophthalmology, a high incidence of EA was observed (Oh AY et al., 2005; Constant I et al., 2010). Most of strabismus surgeries were indicated on this period of life. After the operation, the patient had to lock the eye and it was difficult for the patient to communicate with vision. In these cases, age and fear is more frequent sometimes. This is the reason we chose to observe the age group from 2 to 6 years. From the results, we got the higher incidence of emergency agitation in the interval of age from 3.5 to 5 years. The above graphs 1 show that excluding other factors, the major incidence of agitation have occurred in the 4 year old patients. Furthermore, the graphs 2 above show that the agitation incidence in female children (14%) is higher than in males (11%). Hence, the value of incidence comparing both the male and female group is the same (11%), $p > 0.05$. The combination of general and local (topical, subconjunctival, subtenon) anesthesia is preferred by the anesthesiologist and the surgeon as an additional tool for pain control and for less anesthetics use. Thus, the aim of this study is to apply subtenon lidocaine 2% versus saline injection at the end of the surgical procedure in order to evaluate the efficacy in preventing the EA. This results is shown in graph 3. As seen in the above graphs, other things being equal, the major incidence of agitation have occurred in the

patients of group 1 which were treated with sevoflurane (saline). The graph 3 shows that group 2 and 4 (subtenon), have the lowest incidence. Both groups which received subtenon lidocaine (2%) at the end of the intervention resulted with less incidence of emergent agitation, $P < 0,05$.

Conclusion

Based on the results of this randomized trial, we recommend the subtenon injection of lidocaine (2%) to be 1ml at the end of the surgical procedure for strabismus. It reduces the incidence of EA after anesthesia of sevofluran.

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